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The Identification of Dyestuffs

By T. W. WHATTAM

DESPITE consolidation of dyestuff manufacturing companies in recent years, there are still quite a number of organizations duplicating each others' range of products, and the same dyestuff may appear on the market under any one of several names. Sometimes there is enough of similarity about the name to betray the identity, but in a great number of cases the colorist must be prepared to pierce the camouflage of the new name.

In the sales laboratories of the dyestuff manufacturers there is special need of the ability to recognize and classify the samples which come in, often in great numbers, and at times with only the vaguest of information as to the exact nature of the product. To have to resort to dyeing trials without being sure of the prototype is very costly in both time and materials.

In the mill, too, a knowledge of the method of the identification of dyestuff is very useful, and will often save duplication of colors and waste of space in the drug room, which latter, in the writer's observation, is rarely big enough to allow a proper arrangement of the stock.

For example a woolen mill was using Azo Rubine (Colour Index No. 179), both as an Acid Red and as a Chrome Blue. The identical product was bought from two different houses, under different names, and, of course, a higher price was paid for the dye under the latter designation because it was chrome color, and therefore faster.

PRELIMINARY TESTS

There are a few simple tests which may be applied to any sample of dye under examination which will serve to classify the sample with respect to its dyeing properties. The first thing to do is to blow a little of the dye from a knife point or a spatula blade on to a piece of wet filter paper. If no signs of dissolving are at once apparent, hold the paper over boiling water, when the more insoluble colors—Fast Red A, for example—will begin to dissolve. If no solution takes place after this, it may be assumed that the dye in question belongs to the class of insoluble dyestuffs.

The next step is to repeat the blow-out test on a piece of paper which has been dipped in a solution of sodium sulfide, and hold the paper over boiling water for a few minutes.

A colored solution indicates that the sample is a sulfur color. A third blow-out test should then be made, this time on to the surface of strong sulfuric acid in a shallow dish. This will prove a confirming test for sulfur colors, since they do not usually give any coloration in strong sulfuric acid, but effervesce with the evolution of sulfuretted hydrogen (H_2S), with its "characteristic smell of rotten eggs" as the chemistry books put it.

Many direct cotton colors will also effervesce, but without giving the smell of H_2S. This is due to the fact that such dyes are often mixed with a little soda ash in order to improve the solubility, and also with salt for purposes of standardization in the factory. The sulfuric acid test is also of value at times in detecting mixtures. For example a mixture of Fast Light Yellow with Chinoline Yellow, if blown out on wet filter paper, will appear to be a straight color, but if blown out on sulfuric acid, the latter dye gives a much redder shade of yellow than the Fast Light Yellow, and its presence is readily detected. Or if Azo Carmine (Colour Index Nos. 828 & 829) is admixed with other acid reds, this acid test will reveal the fact, since the Azo Carmine yields a green color in sulfuric acid, while the other acid reds give colorations ranging from orange to reddish blue.

After the above tests have been applied the behavior of an aqueous solution of the dyestuff should be noted when it is treated with dilute solutions of acid and alkali. The best method of doing this is to make a hot water solution of the dye and pour it out on a piece of filter paper. The paper is then spotted with a glass rod which has been dipped successively in the following solutions:—hydrochloric acid, 1 in 10 by volume; acetic acid 50%; soda ash (anhydrous) 106 grams per liter; and caustic soda 120 grams per liter. Any color changes which occur under the action of these reagents should be carefully observed. Occasionally the color of the spot will show a secondary change after a few moments, or will develop a differently colored rim around the spot. A consideration of the color changes effected by these reagents will usually be suffi-

cient to identify the sample, but it is always a good plan to repeat the tests with a solution of the dye to which the sample is believed to correspond. In making these confirming tests the solution of the standard dyestuff and the sample under investigation should be run out side by side on a piece of paper, in order that the color changes may be more easily compared. It is also necessary to make the two solutions approximate in color strengths, since the reactions may vary somewhat with different strengths of the dye solution.

After a little practice it is a comparatively easy matter to identify any given sample in quite a short time, obviating the necessity for laborious dyeing trials.

There are, of course, very many mixtures on the market, under all kinds of names and numbers, put up for special purposes such as union dyeing, cross dyeing, and the dyeing of mode shades. The best way of attacking these is to repeat the blow-out test on filter paper as already described, but blowing out the dye very sparingly. When this is done the small colored spots given by the individual particles of the components do not overlap, and each separate spot may then be treated with the dilute acid and alkaline solutions enumerated above, and the reactions noted. All conclusions should be confirmed by comparative tests against the standard types on the laboratory shelves, whenever possible. Lastly, a comparative dyeing trial should be made against a mixture of the dyes which the sample is believed to contain, and preferably on the textile material for which the product is intended. Careful observation of the rate and degree of exhaustion, and, in the case of union materials, of the way in which the different fibers take up the color, will help to confirm the identity of the mixture.

The various dyeing groups will now be treated in a little more detail, since it is found that certain individual dyes, and also some groups, show characteristic reactions which help to prove their identity.

BASIC DYESTUFFS

This group of dyes contains some of the brightest colors in the range of coal-tar dyes, and, in some cases, the members have a characteristic appearance in aqueous solution, such as the Rhodamines and Phosphines. When a sample is thought to be a basic dye, a confirming test with solution of tannic acid is to be advised, more particularly in the case of the reds. By this means confusion of such colors as Eosin, Acid Magenta, Acid Rhodamine and Phloxine with the similar (in solution) basic dyes is avoided, since the former group will not yield a tannin precipitate. In making a test with tannic acid one should not be too hasty in forming a decision, as the formation of the tannic acid lake is sometimes delayed. An addition of sodium acetate to the tannic acid solution will help to make the test more definite, by neutralizing the acid with which the color base has been combined. Heating of the reaction mixture will also help in the formation of the precipitate.

A number of the basic dyes are also distinguished by their resistance to the reducing action of sodium hydrosulfite. One may cite the Phosphines, the Rhodamines, Thioflavin, and some of the blues. Thionine and Methylene Blues give a colorless leuco compound, which is reconverted to the original blue by air oxidation. Nile Blue, which is somewhat greener and brighter than the above blues, is not completely decolorized on reduction, but becomes temporarily flatter and redder. Auramine may be distinguished from Thioflavine by its property of being decolorized by boiling with dilute acids, owing to hydrolysis.

Basic dyes in general are characterized by their great tinctorial power and their brilliance of tone.

ACID DYESTUFFS

With a few well-known exceptions such as Fast Red A, Azo Yellow, and the Cloth Reds, the acid colors show a good solubility in water, and their aqueous solutions are quite bright. As previously mentioned, there are a few dyes in this group which are quite similar in solution to certain of the basic dyes. Nearly all the chemical families of dyes include some acid colors, hence there is to be found among the individual dyes quite a variety of reactions. No attempt will be made to go into too great detail.

All Pyrazolon colors such as the Fast Light Yellow and Tartrazine show a characteristic behavior if reduced and then allowed to re-oxidize, which serves as a quick and positive test to distinguish them from other acid yellows. A little of the dye is boiled with zinc dust and dilute acetic acid. The solution soon becomes colorless, but if it is allowed to stand for about five minutes there will be observed the formation of a violet ring at the surface of the liquid, due to air oxidation.

A number of the Pyrazolon colors, if dyed on a fabric of silk and wool in a dyebath containing an excess of acetic acid, will leave the silk white. Xylene Light Yellow R and Fast Light Yellow Silk Special are exceptions to this. Chinoline Yellow is distinguished by its resistance to reducing agents, and finds employment for this reason in the printing of discharge styles on silk. Azo and Indian Yellows are of poor solubility, while Metanil Yellow and Azo Acid Yellow are distinguished by their sensitiveness to dilute acids. Milling Yellow O differs from the other Acid Yellows in its color in sulfuric acid, which is crimson, and in its property of crystallizing out from aqueous solution in the form of needles.

Among the many types of Acid Reds which are on the market the Azo Carmine GX and BX give a green coloration in strong sulfuric acid. This property is also shared by Imperial Scarlet, but this latter turns browner and darker when treated in aqueous solution with caustic soda, while the Azo Carmines are unaffected by this treatment. The general run of Acid Reds of the azo type show a tendency to go bluer with dilute acids and to give orange to brown shades with caustic soda. The Alizarine Rubinoles are turned a little bluer by acids, and with alkalis the 3G brand becomes a little bluer, the other Rubinoles showing no change of shade. The Cloth Reds are not

so soluble as the regular acid colors, and, unlike the other reds of the Azo group, become bluer with caustic soda. The G brand is more sensitive than the B, and turns to a bluish violet. Fast Red A is distinguished by its insolubility and its property of yielding a gelatinous solution when a water solution of the dye is allowed to cool.

The brilliant dyes of the Triphenyl Methane group of Acid Colors, which include such well known colors as Patent Blues, Cyanol, Acid Violet 4BN and Guinea Green, show a reaction which is typical of most dyes of this chemical class, namely the yielding of a green to greenish yellow coloration when a water solution of the dyes is treated with dilute hydrochloric acid. The more sensitive of these dyes will show this change even with dilute acetic acid. In this way, for example, Patent Blue V may be distinguished from Patent Blue A. The A brand gives a green spot with Hydrochloric Acid, the V brand a Yellow, while with acetic acid of the strength used in these tests the A mark is unaffected, and the V turns green.

The dyes of the Sulfoncyanine group, such as Nerol Black, Sulfur Acid Blue and Sulfoncyanine 5R, also go greener with acids, and with alkali become redder. These will hardly be confused with the Triphenyl Methane dyes which, as already stated, turn greener with acids, since the Sulfoncyanines are duller in solution and the blues are much redder than those of the Patent Blue and Cyanol types.

Of the acid dyeing anthraquinone colors, perhaps the most common are the Alizarine Saphirols B and SE (Colour Index Nos. 1053 & 1054) which are used to a vast extent for mode shades on woolen goods. The SE brand is faster to perspiration and salt water than the B, and it is sometimes desirable to find out whether a sample of the SE brand contains any of the B. This may be accomplished by the following test, which is based on the greater sensitiveness of the SE type when a water solution of the dye is treated with hot acid:—

One half gram of the sample being tested and the same amount of the standard SE type are weighed into separate beakers, and on each is poured 200 cc of boiling 5% sulfuric acid solution. A true SE brand will show an immediate change to violet. After standing for 2 or 3 minutes the solutions are filtered and dye baths are made up with 20 cc of the filtrate and 130 cc of water. A 5 gram skein of wool is placed in each bath and dyed for twenty minutes at the boil. The skeins are then well washed and dried, and a comparison of them will give an indication of the SE content of the sample being tested. The presence of the B type of Saphirol will decrease the extent of the change to the violet cast.

Azo Blues and Violets such as Victoria Violet 4BS and Azo Acid Blue are very sensitive to both acid and alkali. With acid the color is changed to red or reddish violet, and with alkali a brown or orange spot is obtained, sometimes with a blue rim. Indigo Carmine or Indigo Extract is occasionally met with. It is fast to dilute acids and turns green with caustic soda. A confirmatory test is to treat it with alkali and sodium hydrosulfite, when a clear golden yellow solution is obtained which rapidly oxidizes back to blue on exposure to air.

The Acid Blacks on the market fall into 3 classes. There are the Sulfoncyanine Blacks whose reactions have already been noted. Then there is the most common black, Naphthol Blue Black (Colour Index No. 246), recognized by its greenish black color in aqueous solution, and also by the fact that it is rendered slightly greener by the action of both acid and alkali. There is still another small group, of which Silk Black 4BF is typical, and which are used for silk dyeing on account of their superior fastness to water. These blacks are fast to alkali in aqueous solution and with alkalis they give a bluish green coloration.

Alkali Blues are not often met with. They give a very weak coloration when blown out on filter paper, developing up to a full blue when spotted with acid, and being completely decolorized by the action of alkalis.

DIRECT COTTON COLORS

As a class this group of dyes is not so soluble as the acid colors, and when blown out on filter paper, the color of the solution appears more slowly than in the case of the acid dyes. The color spots, when they do appear, do not readily flow together, but preserve a smudgy appearance. After having been seen a few times this peculiarity of the direct colors is easy to recognize. Generally speaking, the water solutions of the direct colors are not so bright as the acid or basic colors.

A large majority of these dyes are of the azo family, and it is perhaps less easy to determine the individuality of a sample than in the case of the other classes of dyes, due to the close similarity of the reactions of the members of this group, which in many cases differ only very slightly in chemical constitution. For a final decision, dyeings against standard types are the safest guide. A great many direct colors are sensitive to acid, especially mineral acid.

The colors of the Thiazol group, such as Thioflavin S (not to be confused with Thioflavin T, which is basic), Thiazol Yellow, and Primuline (undeveloped) are reddened by dilute acid. Chloramine Yellow is an exception, being unchanged by the strengths of acid and alkali used in these tests. This fact, along with its shade, will serve to distinguish it from all the other Direct Cotton Yellows. Some of the Stilbene Yellows show a good fastness to dilute acid and alkali, but they are redder than Chloramine Yellow. Others of the Stilbene colors are sensitive to alkali, turning redder, and some show a slight blackening with mineral acid. A good confirming test for the Oranges and Yellows of the Stilbene group is to heat up a little dye solution in a test tube and put in a few strands of cotton and silk. The Stilbenes will leave the silk unstained, while other Direct Yellows and Oranges stain the silk to a greater or less extent.

The Chrysamines, being derivatives of salicylic acid, are sensitive to both acid and alkali, being decolorized by

the former, and reddened by the latter. In this respect they resemble some of the Chrome Yellows, which are derived from the same intermediate, but a quick test tube trial with a few strands of cotton will differentiate between them, while in most cases the name of the dyestuff will indicate its dyeing properties.

The remainder of the Direct Yellows, Oranges, and Reds are all blackened more or less by hydrochloric acid. Congo Red and such types will blacken with acetic acid, while the faster colors are slightly blackened by the hydrochloric acid of the strength used in these tests, though unaffected by acetic acid. The Direct Browns in general blacken with acids, and some are sensitive to alkalis, turning redder. In strong sulfuric acid the Direct Yellows, Oranges, Browns and Reds give colorations ranging from blue to violet. On dilution with water the more sensitive dyes yield blue solutions, while the faster ones return more or less to the true color of the aqueous solution.

Of the Direct Blues, a few are fast to acid and alkali, but in general it might be said that they are precipitated from solution by mineral acid and turn redder with alkali. The color of the aqueous solution will help somewhat in placing a sample, but as already mentioned, dyeing tests against known standards may be necessary before any definite conclusion can be formed.

The ordinary Direct Blacks on the market are recognized by their great sensitiveness to the reagents used in these tests, turning redder with acid and greener with alkali. Even soda ash will modify the tone of a Direct Black, and it is possible, within limits, to control the shade of Direct Black by varying the amount of soda ash which is admixed with the dye during the course of a standardization of the batches of Black in the factory. Blacks of the Benzo Fast Black L type are considerably faster to acids and alkalis, and for this reason are much preferred in the dyeing of greys. The domestic brands of this dye give with hydrochloric acid a dull violet and with caustic soda a reddish blue spot with a green rim. Columbia Black FF and similar type turn slightly with mineral acid and yield a greenish blue with caustic soda.

CHROME AND CHROME PRINTING COLORS

By virtue of their lake-forming groups, the dyes of this class are usually sensitive to both acids and alkalis, with the exception of a few of the Reds of the azo group. The Yellows and Oranges of the Azo series are decolorized by acids and reddened by alkali. Modern Yellow, purely a printing color, resists reduction by sodium hydrosulfite, and is further characterized by its appearance in a water solution, which is not clear, but is a greenish yellow suspension.

Alizarine and its sulfonic acids, such as Alizarine Red S, give a violet with caustic soda, while Nitro-Alizarine (Alizarine Orange R) gives a red coloration. Erio Chrome B and Palatine Chrome Red B do not show much of a change with either acids or alkalis. There are a number of Chrome Printing Reds available such as the Chromorhodines which are also fast to acids. They are distinguished from the Azo Reds by their fluorescence and their resistance to hydrosulfite.

Among the Triphenyl Methane colors there are a few Blues of the Erio Chrome Azurol type which are used in both dyeing and printing. These give yellow to yellowish brown water solutions, which turn somewhat redder with acids. The true color of these dyes is only obtained when the combination with the mordant takes place on the fabric. Another group of Chrome Blues, exclusively used in dyeing, are the Chromotropes. These are like the Azo Rubine which was mentioned earlier in that they dye wool red from an acid bath, and develop up to blue shades on afterchroming. These colors give much the same reactions as the Acid Reds of the Azo class.

There still remains a third group of Chrome Blues: the Gallocyanine colors. Gallocyanine itself is the most familiar member of this group. It is sparingly soluble in water, and goes redder with both acids and alkalis, the spot with caustic soda showing a bright blue rim. Other more soluble dyes of this series, Leuco Gallocyanine and its derivatives such as Ultra Cyanine and Chrome Acetin Blue S, are largely used in printing, and since they are not destroyed by the action of hydrosulfite, they are useful in discharge styles. The Leuco Gallocyanines develop up to full shades of blue with caustic soda in aqueous solution. Acid gives shades of reddish violet.

Chrome Violets are not numerous. Modern Violet and Prune Pure are the ones most frequently met with. Both belong to the Gallocyanine family of dyes, and go redder with hydrochloric acid. With caustic soda the color is developed in much the same way as with Leuco Gallocyanines. Modern Violet is converted by hydrosulfite into a colorless leuco compound, which re-oxidizes in air to the original color, and finds more use in printing than in dyeing. Modern Heliotrope and Chromanol Violet RI are similar dyestuffs. These latter are of the basic-mordant type, and will give tannin precipitates, but they will hardly be mistaken for basic colors on account of their comparative dullness of shade.

Like Chrome Violets, Chrome Greens are not very often met with. There is Chrome Green B, which turns red with acids and green with soda ash. Also Erio Chrome Verdone S, which is reddish brown in aqueous solution, becoming redder with acid and bluer with caustic soda. The well known Alizarine Cyanine Green is often used as a chrome color on account of its comparative brightness and the increased fastness to milling which it shows on afterchroming.

There are a number of Chrome Browns available, mostly belonging to the azo class, which are brownish in aqueous solution, more or less sensitive to acids, and not specially soluble in water. These azo dyes are distinguished from the true Alizarine Brown (Colour Index No. 1035) by the insolubility of the latter in water, and its solubility, with change of shade to greenish blue, in caustic soda.

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Washington News Letter

By WALDON FAWCETT

THE compilation staff at the National Bureau of Standards has all but completed the manuscript of a revised edition of the Directory of Commercial Testing and College Research Laboratories. Textile chemists and colorists have been in position particularly to realize the need for modernization of the principal check list of independent agencies of commercial testing. The original directory,—compiled by Miss Ann E. Rapuzzi under the direction of Mr. A. S. McAllister, was published in 1927 with a Supplement in 1929. There is no need to dilate on the changes of conditions and of facilities wrought by the ensuing years.

A double purpose is the animus of the Government in its present undertaking, as it was eight years ago. On the one hand is the consideration that the Government has restricted rather than enlarged its ability to conduct for the public tests of commodities to determine whether or not they comply with purchase specifications. It has never been the policy of the Government to make tests for private individuals if other laboratories can do the work. Latterly, however, the volume of official testing has reached such proportions as to virtually exclude even that minority of commercial tests which cannot be so readily conducted elsewhere or which tradition has delegated to the Governmental agencies. Hence a need to muster whatever commercial resources may be available, to fill the gap.

The second incentive to maintenance of a Governmental clearing house for information on commercial testing laboratories is a belief at Washington that the existence of a thoroughly classified list of commercial testing laboratories will promote the use of standard specifications, particularly by the large number of purchasers who have hitherto hesitated to buy on specifications. The project of unification of specifications is a form of missionary work dear to the official heart of the National Bureau of Standards. Balking the realization of any dream of universal use of specifications, stands the suspicion of great numbers of the smaller purchasers that manufacturers are wont to work off "seconds" on purchasers who are known to have no facilities for scientific verification. At the Bureau of Standards there is conviction that just in proportion as commercial testing facilities can be brought within the easy reach of local, regional, and small-order buyers will there be conversion to the ideals of standard specifications. The original list tabulated 271 commercial testing laboratories supplemented by 92 branch laboratories and 186 college laboratories,—many of which latter carry on research work. Allowing for the mortality in the period of business depression, it is expected that the revised lists will show a considerable increase.

Commercial laboratories are listed, alphabetically, by States and Cities, and in addition to the name and address of the laboratory, there is notation (by key numeral and letter) in each instance of commodities and nature of tests. Thus "c" signals specialization on chemical tests, whereas "a" betokens facilities for testing products for "appearance". Similarly, "s" denotes a range of testing with the objective of ascertaining the resources of service, performance and calibration. Most of the textile chemistry laboratories listed announce a range of research that embraces some measure of the "physical and mechanical".

Textile interests come to the surface at various points in the break-down of the types of commodities open to commercial testing at the listed institutions. There is a major classification of Textiles with subdivisions covering cotton, cotton fabrics, wool, silk, etc. Textile machinery appears as a subclassification of the machinery group. Chemicals and Allied Products is decentralized via segregation respectively of coal-tar products, Acids, Miscellaneous Chemical products, etc. Finally, Dyeing Materials of Vegetable Origin are within the jurisdiction of that section of the Directory devoted to "Vegetable Products".

INCREASE FOR COLOR INVESTIGATIONS

If the 1935-36 appropriations for the Department of Agriculture are apportioned as planned, there will be an increase of $3,247 in the expense account for Color Investigations by the Bureau of Chemistry. The budget of $69,757 for next year is yet in contrast to the allowance of $93,460 for the final year prior to the New Deal. That the operating fund has started the climb back is, however, encouraging. Not to mention recent Public Works allotments for repairs, replacements, etc. at the Color Laboratory.

The color program, financed as above, is for investigation and experiment in the utilization for coloring and technical purposes of raw materials grown or produced in the United States. Work in this sphere has several objectives. First, chemical research on the development of new color substances particularly applicable to American agricultural materials such as cotton, the synthetic cellulose fibers and wool. Second, investigations to increase the use of these materials by the development of more economical methods for the production of dyes especially applicable to them. Third, fundamental research on the utilization of agricultural crops and byproducts by mold

fermentation processes for the production of valuable chemical compounds not readily obtainable by other means. Fourth, cooperative investigations with other agencies in the preparation, examination and utilization of color substances and other products used or produced in their investigations. Federal officials have represented to Members of Congress that upon the above-mentioned researches are largely dependent the maintenance of a reliable and continuous source of essential dyes, stains and chemicals.

WANTED,—RECLASSIFICATION OF PATENTS

Textile chemists and colorists are to be solicited to give support to the movement for reclassification of patents. It is claimed that conditions in the Patent Office have now reached the point where it is no longer merely desirable, but is downright essential to undertake the program of classification which has been hanging fire since 1912. Qualified investigators estimate that proper and adequate classification of the arts in the Patent Office would increase the efficiency of the examiners by not less than 10 per cent; would materially lessen the cost of examination; and best of all, would attach to future patents a greater degree of validity.

Since the Patent Office is (for the first time since 1922) again on a self-sustaining basis—showing last year, a surplus of more than half a million dollars, actual receipts in excess of expenditures—it is urged that there is no excuse for not restoring the Classification Division. If this key Division could be rebuilt to at least the size of the 1914-18 average, when 20 Examiners and a proportionate clerical force was engaged in the work, it is claimed that the needed revision of classification could make headway.

With the limited appropriation available, the Patent Office officials have, this past year, started the work of reclassification, operations having started, however, in only 13 classes out of the total of 57. Classes such as textile chemicals, etc., where the past score of years has witnessed notable development and the set of new trends, are, of course, in particular need of reclassification and modernization. The mere volume of invention in classes such as this, where there is exceptional activity, has operated to slow down routine where the original classification lines are very poorly defined. The theory of a modern, accurate, scientific classification is that the prior art in each subclass would be made so readily available to the Examiners in their searches that they could determine with the least amount of effort and with a high degree of accuracy, the measure of novelty which resides in a new application.

COLOR WORK AT U. S. PRINTING OFFICE

Colorists in quest of the germs of suggestion will not scorn that unsung source of research, the Division of Tests and Technical Control of the U. S. Government Printing Office. Incident to the manufacture of ink, the Technical Director frequently essays exploration in the field of color. As an example of the results there may be cited the recent development at the Technical Division of a special ink for use on tracing cloth, parchment drawing papers, etc. Similarly, at the request of the Weather Bureau there was developed a special brown copying ink for use in printing air maps. It may be added that the Technical Division also concerns itself with bookbinding research which deals extensively with book cloth and has embraced over a period of years continuous research on the pyroxylin-treated fabrics.

WHAT TENURE, DESIGN REGISTRATIONS?

Cropping out frequently in the discussions at Washington of the future of the NRA is the controversial question of the proper duration for the design monopoly created by Code Authority. It is plain, of course, that this issue of the proper term to be alloted for exclusive possession of an original design is bound up with the larger question of the fate and future of the NRA. Even though the present administrative structure be abandoned, however, the riddle will remain if design enrollment bureaus prove to be one of the permanent heritages of the new era of self-government in business.

As a matter of fact it is just because Code Authorities, which are presumed to speak with finality, have so differed in policy, that debate has been joined on the question of design tenure. Certain design registration bureaus set up under certain Codes have limited exclusive enjoyment of an original design to one year. Other clearing houses, similarly sponsored, have made the standard grant two years, or an even longer period. The suggestion has been lodged at Washington that a standard period be fixed for all designs. This has been met by the objection that in lines such as textiles, where the fashion element is important and where style rotation is rapid, the period of design monopoly may, logically, be more brief than in commodity lines where the demand is less insistent for novelty and variety. One school of thought holds that a sceintific determination requires ascertainment of the average "life expectancy" of a design in the field to be regulated. Or in all design-dependent lines, if an attempt is to be made to fix one rule for all.

ACCESSORY INDUSTRIES KEEN ON COLOR TRENDS

Reporters and forecasters of color preferences and color trends in fashion are encountering, latterly, a new strain of curiosity. The new-found seekers of advance information on tomorrow's best-selling colors are members of subsidiary and accessory industries,—producers of adjuncts and novelties to be worn with or used in connection with articles of dress, house furnishings, etc., which are rendered in unique, seasonal or high fashion colors.

That this numerous new clan of color-conformers has taken to spying out the trends is due partly, but only partly, to the latter-day importance of color in industry and the systematic effort to provide harmony of color in dress ornaments and appointments. In no less measure is the sudden spurt of curiosity due to the fact that new or elaborated industries have lately appeared on the scene

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MAY 6, 1935

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Members should notify the **Secretary** immediately of all address changes

TEXTILE FOUNDATION RENEWS SUPPORT OF RESEARCH COMMITTEE

AT a meeting of the Directors of the Textile Foundation held in Washington April 17th, the research work of the American Association of Textile Chemists and Colorists was reviewed and a grant of $9,500.00 was made so that the work of its Research Committee might be continued during another year.

The special projects for which grants were made are as follows:

Fundamental Study of Vat Printing Pastes (Continuation).

The Effects of Oxidizing and Reducing Agents on Wool (Continuation).

The Quantitative Determination of Fibers in Mixtures.

The Determination of Oil, Soap and Other Extraneous Material in Wool at Various Stages of Wool Processing.

The continued support thus rendered by the Textile Foundation not only encourages the Research Committee in its persistent effort to develop research work in this country as regards textile chemistry, dyeing, bleaching and finishing, but also should have a stimulating and educational influence upon the textile industry of America.

The present directors of the Textile Foundation are Franklin W. Hobbs, President, Arlington Mills, Boston, Mass., Chairman; Stuart W. Cramer, President, Cramerton Mills, Cramerton, S. C., Treasurer; Henry A. Wallace, Secretary of Agriculture; Daniel C. Roper, Secretary of Commerce; Frank D. Cheney, Cheney Brothers, New York and Edward T. Pickard, Secretary.

FEBRUARY MEETING, NORTHERN NEW ENGLAND SECTION

A REGULAR meeting of the Northern New England Section was held February 1, 1935, at Riverbank Court, Cambridge, Mass., with an attendance of 40. B. A. Ryberg read a report of his research work at the Lowell Textile Institute on "Aluminum Chloride Carbonizing." Mr. Ryberg's interesting paper, supplementing his previous work on Sulfuric Acid Carbonizing, elicited considerable interesting discussion of this important subject.

Respectfully submitted,

CLARENCE L. NUTTING,
Secretary

Proceedings of the American Association of Textile Chemists and Colorists

Review of the

Wool Carbonizing Project

Parts IV and V*

By **ROLAND E. DERBY**
Chairman of Sub-Committee

THE work of sulfuric acid carbonizing, as carried out by Mr. Ryberg, has been drawn to a conclusion. It does seem as if we have covered all practical phases of this subject. Certainly we have shown where failures have been caused, and how to correct them in a great many instances.

A careful study of these fundamental facts brought out in Mr. Ryberg's research should certainly serve to improve all sulfuric acid carbonizing equipment. A great many of the points which he has spent time on have been useless and have not shown any hoped-for results, but it is often as necessary to prove that a statement is unfounded, as it is to prove its worth.

In his last portion of work he has shown two important phases of the sulfuric acid carbonizing method. First, that cold water neutralizing is in general the most satisfactory way of rinsing carbonized goods; and second, that elevated soaking temperatures show some decided effect in the way of penetration and more level acid content. The fact that the ammonia nitrogen content is greater at low soaking temperatures than at high, shows us that there is certainly a possibility in raising the temperature of the soaking bath to prevent resisting the wool in the drying chamber. While we would not expect this to completely remove that difficulty if the drying chambers were not satisfactory, it might be just enough to prevent trouble where the drying chamber was almost right.

The opportunity for improvement in sulfuric acid carbonizing equipment, through a study of Mr. Ryberg's work, is worthy of mention. It does seem as if some enterprising machine manufacturer could take up this proposition of carbonizing equipment, and by some form of construction devise a drying chamber which would provide, fresh unsaturated air at an approximate temperature of 180° F., in large quantities, and at high rates of speed, and pass this air through the cloth in such a way that it would quickly absorb the moisture, and then on the other hand, remove this moisture-saturated air as quickly as possible from the cloth so that there would be a very short time in which acid, moisture, and heat were in contact with the wool at the same time. With proper suction fans and blowers, it would seem as if the extent and length of the ordinary drying compartment could be greatly reduced, as also, very possibly, the time of passage through this compartment could be reduced. Mr. Ryberg has shown that the time necessary for exposure at the high temperatures of the baker is very short, and if the moisture has been completely removed, this chamber could have practically no ventilation whatever. This knowledge should tend to shorten up the length of our present carbonizing equipment, and reduce the time of operation.

Thus, there are three phases of sulfuric acid carbonizing which could be well investigated by machine manufacturers. First, the value of elevated soaking temperatures; second, the construction of some form of air drying equipment to increase speed of moisture removal, and to reduce the time of exposure in the drying chambers; and third, a short, very high temperature baking chamber.

This work on sulfuric acid carbonizing has been proven a great many times since the publication of our first work last year. In a number of mills it has been brought to our attention that they have improved their work by lowering their drying temperature, and increasing the flow of air through their dryer. In one particular instance, it has been noted that in a case where very excellent drying conditions were available, that it was possible to shut off the vacuum slot entirely on the first half of the cut of cloth, and apply it full force on the last half of the cloth, and process this cloth at a slower speed through their drying chamber, wherein the moisture was completely removed at lower temperatures, between 160°-180° F., and that this particular cut of cloth, when dyed in the piece and finished, showed no ill effects whatever. This one instance proves the value of our work more than any other which has been brought to our notice.

There is but one other phase of sulfuric acid carbonizing that may sometime be of interest, and that is the removal of silk in the presence of wool, by a reversal of

*This interpretative resumé of Parts IV and V of the Wool Carbonizing Project is published for the benefit of textile manufacturers who may not be able to follow all of the highly technical nomenclature involved in these papers. Parts IV and V will be found in the March 25, 1935 American Dyestuff Reporter, Part IV on page 142 and Part V on page 150.

these aforementioned control methods, that is, by allowing the moisture, acid, and high heat to be in contact for a great length of time with the wool. This possibility does not seem to be at present of much practical use, because of the value of the silk fiber, and the danger of destruction to the wool fiber by this method.

The work on aluminium chloride carbonizing has been very complete, and should provide a very good reference for those interested in aluminium chloride carbonizing. The methods of use, the reason for testing the acid content of saturating solutions, have been given in complete detail, and we believe this is the one work which gives this outline in such form as can be applied in a practical way. This study of aluminium chloride carbonizing has brought out very clearly the reasons why aluminium chloride has been used in a great many cases instead of sulfuric acid. It certainly has some advantages in a few instances. While the cost of aluminium chloride carbonizing is much greater than sulfuric acid carbonizing, it is often necessary to use this method where the condition of machinery and equipment make it imperative. I think it may be safely said that the actual cost of chemicals used for aluminium chloride carbonizing is 6 to 8 times more than the cost of chemicals used in sulfuric acid carbonizing. This does not mean that the whole cost of carbonizing is 6 to 8 times greater, because the labor, and steam, and power requirements will have their portion of cost, equalized in either case. This should not be considered as part of the relative cost between the two methods.

The most striking portion of Mr. Ryberg's work on aluminium chloride carbonizing is his discovery that the wool is least affected when the conditions of drying are highest. This question should be an indication to the machine manufacturers that there is a great opportunity for improvement in carbonizing equipment for the use of aluminium chloride. It would seem as if the drying and baking equipment in the case of aluminium chloride would be united. In other words, all that seems necessary is a very high temperature. No removal of moisture is necessary as in the case of sulfuric acid, as the presence of this moisture seems to aid the carbonizing and does not seem to have the destructive effect on the wool that it does in the case of sulfuric acid. In other words, the work with aluminium chloride has proven that the methods used in this case are exactly opposite to those necessary when using sulfuric acid. In a great many practical instances, this has proven to be the case, and a good many mills have in use for baking equipment, simply an old dryer in which they have added steam coils to elevate the temperature to approximately 260° F., and there is no division between drying and baking, and no means of ventilation except natural ventilation through air ducts in the roof of the dryer. Perfectly satisfactory results are obtained, no resisting of the wool takes place, and troubles are few and far between.

Another very important portion of Mr. Ryberg's work is his discovery that the easiest and most complete method of removing the residual aluminium in the carbonized material is through proper and thorough dry milling. It has always been considered that it was necessary to boil-out the cloth with water, and then with muriatic acid, and again with ammonia before this cloth could be in a suitable condition to dye, although it is a known fact that in a great many instances mills have been running for years without any preliminary treatment of the cloth between carbonizing and dyeing. Since Mr. Ryberg has made note of this fact, we have known at least one instance where this preliminary boiling system has been eliminated, and careful attention given to dry milling after carbonizing with very satisfactory results.

The fundamental facts outlined in this work on aluminium chloride carbonizing give us a new insight into the use of this chemical for the removal of vegetable matter in the case of either raw stock or pieces.

While we did not do any great amount of work on the method of carbonizing which used dry hydrochloric acid gas as a carbonizing agent, the reactions of muriatic acid in the case of aluminium we believe to apply exactly in the same manner to the reactions of hydrochloric acid gas in this process. This research has been confined to laboratory work for the most part, but due to the accessibility of woolen mills in this area, we have been able to check all of Mr. Ryberg's work on a large scale, and have done so whenever it seemed valuable.

The assistance of Mr. Leach, Mr. Christison, and Mr. Monro, at the Pacific Mills, the Arlington Mills, and the American Woolen Co., as well as the assistance and experiments carried out by M. T. Stevens & Sons Co., have been a valuable asset to this work.

MARCH MEETING, NORTHERN NEW ENGLAND SECTION

A REGULAR meeting of the Northern New England Section was held March 8th in the auditorium of the Administration Building of the American Woolen Company, Shawsheen Village, Andover, Mass.

R. J. Wig, Vice-President of the Frosted Wool Process Company of California, presented a paper on a new process for removing grease, dirt, burrs and other extraneous matter from wool, as developed at the Lowell Textile Institute.

There was an enthusiastic response by officials of many woolen and worsted mills to the invitation of the Section to attend the meeting, about 250 members and guests being present.

Respectfully submitted,

CLARENCE L. NUTTING,
Secretary

Discussion of Paper on Aluminium Chloride Carbonizing*

Mr. Zillessen: I wonder why you didn't use direct colors as an indicator. In the woolen business, they use carbonized shoddy for filling with cotton warp and then dye those with direct colors.

Mr. Ryberg: I used virgin wool and the acid colors. I suppose we should go into the effect on direct colors to make it complete.

Mr. Zillessen: They do carbonize shoddy but not with aluminium chloride.

Mr. Derby: There isn't any aluminium chloride carbonizing of shoddy done in New England as far as I know, but there is gas carbonizing. I would expect in the case of direct colors on wool, that you would have to so thoroughly neutralize the cloth and dye it in the neutral bath that these conditions wouldn't be exaggerated as they are in an acid bath. As Mr. Ryberg has shown, the muriatic acid is the active agent which causes the discrepancy and in the case of neutralized stock, you wouldn't have any muriatic acid present. The changing of the fiber itself is less in the case of aluminium chloride carbonizing than it is in the acid carbonizing. That might indicate that you couldn't notice it with direct colors.

Mr. Grady: I notice there is no acid added afterwards in the dyeing operation. What effect would an addition of acid have?

Mr. Ryberg: I shouldn't think it would affect it. I think it would still show up the differences. If you took a piece of aluminium chloride carbonized cloth with an uncarbonized piece and used a little oil of vitriol, you would still see a difference in the two pieces. However, they don't dye carbonized with uncarbonized goods, except for experimental purposes.

Mr. Grady: I noticed that you used C. P. aluminium chloride. Are there any impurities at all in it?

Mr. Ryberg: There is a very small trace of iron. That is the only thing, and that is very, very small.

Mr. Lincoln: That is in the C. P.?

Mr. Ryberg: In the commercial product I don't know. I imagine there is a very small amount of iron and a little sulfate.

Mr. Grady: This is apart from the subject, but I'd like to ask what would be the outcome if you dyed acid colors with muriatic acid.

Mr. Derby: They would dye, but not very level. I did it once and the results were very poor, and I never tried it again. However, on some stocks they do dye more level. Mohair, for instance, or any stock with a percentage of lime can be dyed with Astrole, Floxine, Fast Light Yellow, using one per cent muriatic.

Mr. Grady: But, did you use it right in the dye pot?

Mr. Derby: Yes.

Mr. Grady: You say Mohair. How about tanner's wool?

Mr. Derby: It doesn't work so well. We find that formic works a good deal better than either vitriol or hydrochloric or a combination of those three on tanner's wool.

Question: Mr. Ryberg, what was your explanation of the fact that some colors that are not wholly level dyeing on uncarbonized pieces are much more so in a neutral dyeing on carbonized pieces such as Indocyanine?

Mr. Ryberg: I think sulfuric acid actually effects an oxidation of the wool which is not the case with aluminium chloride. It tends to dye more even whereas with the sulfuric acid there is a partial and uneven oxidation of the wool.

Mr. Derby: We find that especially true on fabrics where there are three or four different stocks in a blend, they dye more solid and more evenly, that is, from side to side.

Mr. Ryberg: That is what I tried to show here. With the aluminium chloride it is more easy to dye the material evenly.

Question: Would you be willing to state, Mr. Ryberg, that carbonizing done with aluminium chloride alone has no chemical effect on the wool?

Mr. Ryberg: No. I don't think so. I think it has an effect. I have shown here that there was a small increase in affinity, but there is some work in that connection that I haven't had a chance to do. The length of time you soak in the aluminium chloride affects it. The longer it stays in, the more it takes up the hydrochloride acid from the hydrolysis of the aluminium chloride, whereas if you just saturate it with the chloride solution, you have only so much there. Whether that decomposes or not, there is only so much there to work with. If you let it soak one-half hour instead of only 15 minutes you should see a greater difference in shade.

Mr. Derby: Do these increases still hold true if you completely neutralize the material?

Mr. Ryberg: Yes.

Question: Has any one had experience in the use of penetrating agents in conjunction with an aluminium chloride carbonizing bath?

From the floor: Some of them won't work with aluminium chloride as well as they do with sulfuric acid.

Mr. Nutting: Mr. Chairman, I think one of the essential points that Mr. Ryberg has brought out is that the effect of the hydrochloric acid is just the reverse of the

*At the February 1925 meeting of the Northern N. E. Section, B. A. Ryberg presented a paper on the Aluminium Chloride Method of Carbonizing. (See March 25, 1925 Edition ADR, page 150.) The discussion which followed is now published.

effect of sulfuric acid. The thought that comes to my mind is, what are the possibilities of the combination of these two acids for carbonizing, in such a way that they will not effect any change in dyeing properties? Can you control the dyeing properties by the use of both acids so that you may derive a satisfactory process that may be more fool-proof than either the chloride or sulfuric methods?

Mr. Ryberg: If the wool would tend to absorb both equally, it might do it.

Mr. Nutting: You could vary your relative concentrations so that the one might offset the other and thereby get a carbonized stock which would dye like uncarbonized stock.

Mr. Ryberg: Wool still might tend to absorb the small amount of hydrochloric acid. You couldn't hold the ratio constant.

Mr. Derby: Did you think it might arrive at the same result by using aluminium chloride solution? I think from my experience that aluminium chloride baths are often allowed to go uncorrected. That is, no acid is added which soon gives a basic aluminium chloride.

Mr. Ryberg: One of the products of hydrolysis is basic aluminium chloride. It reaches such a concentration eventually that it prevents further hydrolysis.

Mr. Derby: I wonder if you could bring it back by adding more chloride.

Mr. Ryberg: Yes. But, you would have to use so much of it. You have two things to consider, wool and vegetable material.

Mr. Derby: In regard to Mr. Nutting's question, perhaps I can refer to a practical trial that may give him some information on that. At one time, we had a piece of goods made up half of the filling with aluminium chloride carbonized stock. The piece was afterwards acid carbonized in the piece and dyed with acid colors. Right at the point where the carbonized filling stopped there was a change of color. The aluminium chloride portion was three times as dark in shade, which shows the increased affinity even though it was afterwards carbonized with sulfuric acid.

Mr. Nutting: That is particularly interesting because any stock which is twice carbonized by the sulfuric acid process is usually doubly resisted.

Mr. Peever: I don't think it would be possible to work out a process using vitriol and aluminium chloride because if you are using a baker with aluminium chloride and you run neutral uncarbonized pieces through with acid fumes in the baking chamber, you get all kinds of shaded goods and resisted shades, and the same holds true in running vitriol pieces. You could never hit upon a satisfactory balance.

Mr. Healy: Has anyone tried ordinary alum as a carbonizer? Are you familiar with a process of Aetzing? It is an embroidery idea, silk and wool being sewn on a very thin piece of cotton. The cotton is tendered and that can be removed very readily and it leaves the design.

Anonymous: I tried some alum on shoddy without success.

Question: Is there any particular advantage of dyeing and then carbonizing? One man says the best results are obtained by using aluminium chloride. The goods are dyed first and then they are carbonized.

Mr. Ryberg: That is the way most people get around uneven dyeing and resist spots. If you use the proper colors you can do it. There is less shade change in aluminium chloride carbonizing than if sulfuric acid is used.

Question: What is the estimated difference in the cost between aluminium chloride carbonizing and the other?

Mr. Ryberg: I don't know.

Mr. Healy: Aluminium chloride is much more expensive, about three times. If you figure the cost of raw material, the acid carbonizing job can be done with perhaps five pounds of acid per one hundred pounds of goods and with acid at two cents per pound that is a small cost. With aluminium chloride, ten pounds of crystal material are needed for one hundred pounds of material costing six cents per pound.

Dr. Chapin: Isn't there considerable more cost in the upkeep of equipment?

Mr. Healy: No. I don't think so, if you arrange for it before hand. A lot of your cost depends on your equipment. I'd say if you had a good apparatus where you could save extracted liquors that a fair comparison to estimate between sulfuric acid and aluminium chloride would be a two-cent cost with sulfuric and 12 cents with aluminium chloride.

Question: Would there be any particular risk in losing your pieces in sulfuric acid carbonizing, i.e., with a piece being destroyed?

Answer: I think that is very true. That is why they used aluminium chloride, for safety, in carbonizing.

Question: Can you toss the piece back and rework it?

Answer: With sulfuric the piece is gone.

Mr. Peever: We ran a test for ten weeks and figured the cost per yard with the open tank equipment, squeeze rolls and extractors. One cost 1¼ cents and the other 3 cents. We ran the vitriol at 4° and aluminium from 6° to 7° Twaddle.

Question: Isn't there danger of white resist spots from aluminium chloride? You are speaking of dusting to remove aluminium compounds.

Mr. Ryberg: You have these white compounds on cloth which are basic compounds of aluminium.

Anonymous: We had such an experience a while ago. We found that when running the carbonizing baker at

(Continued on page (163) 255)

Proceedings of the American Association of Textile Chemists and Colorists

Stainless Steel in the Textile Industry*

By JOSEPH E. GOODAVAGE†

WHILE the chemist has been discovering new dyes and new methods for their application, the mechanical engineer has been actively engaged in devising machines suitable for carrying out, with a minimum of labor, all the operations connected with dyeing. This introduction of improved machinery into the dyeing trade has resulted in the production of better work. It has effected considerable economy, and may be regarded as an important feature of modern dyeing.

In following the development of dyeing machinery, we find that the materials used in their construction play a very important part in regard to efficiency and quality of work produced. Where the dyer is confronted with the problem of producing brilliant colors or with the dyeing of fabrics containing two or more different fibers, it becomes necessary to use the various classes of dyestuffs, some of which stain wooden equipment, especially the direct dyes.

The wooden equipment being of a porous nature, readily absorbs dye solutions and these are removed only after a vigorous boiling, often requiring the use of alkalies or bleaching agents to completely extract them, before the apparatus can be used for the dyeing of another color. In time, by such drastic treatment, the cellulose structure breaks down and the smooth surface of the wood is transferred into a rough uneven one that catches or pulls any textile material coming into contact with it. Considering the cost of labor, chemicals, steam and the unproductivity of such equipment while being "boiled out" for another color, in time the cost will amount to a sum more than enough to pay for the lining of the tub or machine with metal.

The silk dyeing industry has had the greatest amount of experience with metal linings. The nature of the fiber requires the use of smooth surface equipment. The silk hosiery dyeing industry has benefited considerably by the advantages offered by metal equipment and it can be safely stated that wooden equipment in hosiery dyeing, is in the class of the "horse and carriage." The success of metal equipment in this branch of dyeing is due principally to the non-corrosive nature of the dyeing assistants. Though the nickel-copper alloy of which most of these machines are made yields good results in hosiery dyeing, in other fields of dyeing where more corrosive chemicals are employed, the results fall short of expectations.

In considering the metals available for the fabricating of dyeing equipment for the industry in general, we find these are divided into two classes:

1. Non-ferrous metals.
2. Ferrous metals.

The first class includes such metals as copper, nickel, aluminum, lead, tin and the various alloys such as brass, bronze and the nickel-copper alloys. The second class includes iron and its alloys, of which the most important is stainless steel.

In the woolen industry, where corrosive acids are employed, metal dyeing equipment is constantly subjected to conditions far more severe than in other fields of dyeing. The suggestion of metal equipment to a wool dyer, especially one who is producing brilliant colors, will usually bring forth the question, "What effect does it have on the colors?" His past experience has taught him to approach the question of metal equipment very cautiously, and you are reminded that metals have a tendency to sadden or dull the dyeings.

The dulling or saddening of acid or chrome colors in metal equipment can be due to any one or a combination of any of the following effects:

1. A reduction of the dyestuff brought about by the hydrogen liberated from the acid of the dyebath when it reacts with a metal. In some cases the change in color is slight and in very severe cases a complete destruction of the dye can take place.
2. The dyestuff in the bath reacts with the metal salt forming a color lake and as such is absorbed by the fiber. This reaction is characteristic of chrome colors and in some instances, a color entirely different from the one expected, is formed.
3. The dulling of the dyed material by the absorption of a metallic salt, the latter not reacting with the dyestuff in any manner whatsoever, but merely dulling the dyed material by being present in the fiber.

From the above it can be assumed that metals which readily go into solution in the acid dyebath are the most troublesome. Where copper or brass equipment is used

* Presented at meeting, Philadelphia Section, January 11, 1935.

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in applying certain acid or chrome colors, it is necessary to add sulfocyanate of ammonia to form an insoluble coating of sulfocyanate of copper. While this treatment affords temporary relief, it must be repeated from time to time and even this treatment is not completely effective with all colors. In the non-ferrous field, a use can be found for each metal in the textile industry, some are more suitable than others for certain operations, but considering each from a point of general adaptability, we find the choice narrowing down to the nickel-copper alloy known as "Monel metal."

In the ferrous metal field iron itself, on account of its poor resistance to acids and the readiness with which it reverts to the oxide commonly known as "iron rust," is probably the most troublesome metal in textile processing. Stains, dull colors, and tender bleached material are some of the faults often traced to iron equipment.

In alloys with nickel or silicon the resistance of iron to corrosive liquids is considerably increased, but the mechanical and physical properties of these alloys are such as to limit their use for textile work. The most important contribution to the ferrous alloys was the development of stainless steel.

The term "stainless" as used in the steel industry, embraces a number of alloys of various chemical compositions, each differing in physical and mechanical properties, corrosion resistance, etc.

Stainless steels can be divided into two general classes:

1. Ferro chrome steels.
2. Ferro chrome—nickel steels.

The advent of these two classes occurred at practically the same time (1914), the ferro-chrome in England, the chrome-nickel alloy in Germany.

Both of these alloys were more or less "accidental" as far as corrosion resistance was concerned, being the result of careful observation during the progress of investigation on heat resistant alloys.

The corrosion resistance of these alloys is attributed to the chrome content. Theoretically, the chrome develops an invisible chrome oxide film on the surface of the metal which is impervious to penetration by atmospheric conditions and also to a great number of chemicals.

The straight ferro-chrome alloys containing 12-14% chromium are hard and low in ductility. They become brittle after welding if not heat treated. By increasing the chrome content to 18%, with the addition of nickel, an alloy possessing greater corrosion resistance than that of straight chrome analysis is obtained. This is very ductile and of high tensile strength. It can be welded without loss in strength, ductility, or corrosion resistance.

An alloy of this type is "Enduro" 18-8-S, having the following analysis:

Carbon	.08%
Manganese	.60%
Phosphorus and sulfur	.03%
Silicon	.75%
Chrome	16.5-20%
Nickel	7.0-10.5%

This type possesses sufficient resistance properties for practically all textile dyeing applications, but where high resistance to acids is required, particularly to carbonizing strength, the type 18-8-S-MO is recommended. This alloy contains more nickel and manganese than the above and in addition has 2-4% molybdenum.

18-8-S-MO has proven itself to be superior to other metals in combating the corrosive sulfite liquors in paper making, and is successfully employed in the manufacture of cellulose acetate where it is subjected to the action of acetone and acetic anhydride. Both alloys being of low carbon content (.08 maximum), they thus prevent the separation of carbides in the grain boundaries during welding, which defect was so evident in the earlier higher carbon analysis of this type.

The resistance of these alloys, compared to that of nickel-copper alloy, against some of the corrosive substances used in the textile industry, is shown in Table I.

THE "OVER-NIGHT" TEST

While testing 18-8-S MO against various acid and acid-chrome colors for metal effect, the procedure employed was that regularly recommended for their application to wool, i.e., after addition of the required amount of acid, Glauber's salt and dyestuff, the dyebath was diluted to a volume of 200 c.c. The temperature of the bath was raised to 140° F. and a 5-gram skein of 2/60s worsted entered. The temperature was then gradually raised to the boil over a period of one-half hour and then boiled for one-half hour. The dyeings were carried out in porcelain beakers in which metal sleeves of "Enduro" 18-8 S Mo were inserted.

These were checked against dyeings made under identical conditions in porcelain only. In addition, dyeings were made for the purpose of comparison against nickel-copper alloy. After eighty dyeings, each with a different dyestuff, the following results were obtained:

18-8-S MO—no color change.

Copper-nickel—15 dyeings were affected.

The dyeings affected by copper-nickel were the yellows, reds and oranges in the acid colors; the browns, greens and certain blacks in the chrome colors.

In view of the fact that there was no apparent effect on the colors when dyed in "Enduro" 18-8 S Mo by the regular method, as employed for the acid and the chrome colors, it was decided to employ a more drastic test, leaving the dyebath (containing the color, acid and salt) in contact with the metal for a period of 15 hours or overnight.

After a 15-hour period the dyebath was heated, the skein entered, and the dyeing carried out according to the regular procedure. This procedure deviates somewhat

from the methods used in the practical application of these dyes; its main object is to magnify the "metal effect" wherever this occurs. For comparison this test was applied to copper-nickel alloy also.

The conditions under which the tests were carried out in regard to surface of metal exposed to the bath, acid, dye, salt, etc., were alike in all cases. Dyeings were made with the dyes listed in Table II according to the "overnight" test.

CORROSION TESTS

In order to determine if any corrosion takes place by repeatedly using fresh acid (of dyeing strength) for each dyeing, the following test was emloyed:—

The metal sleeve in a porcelain beaker was subjected to the action of acid and Glauber's salt at the boil for two hours. The bath was then discarded and the beaker and the metal sleeve rinsed with cold water.

Fifty tests (100 hours) were carried out, using sulfuric, acetic and formic acids respectively.

These baths were of the following average pH:

Acetic	3.95
Formic	2.85
Sulfuric	2.02

The area of metal in contact with the acid bath was approximately 42 square inches in each case.

	Original Weight	*After 50 Tests*	*Loss in Weight*
	ENDURO 18-8-S Mo		
Sulfuric	120.956 gms.	120.953 gms.	.003 gms.
Formic	121.703 gms.	121.700 gms.	.003 gms.
Acetic	127.147 gms.	127.147 gms.	.000 gms.
	COPPER-NICKEL		
Sulfuric	165.109 gms.	164.40 gms.	0.709 gms.
Formic	160.07 gms.	158.73 gms.	1.34 gms.
Acetic	165.82 gms.	164.63 gms.	1.19 gms.

TABLE I

	Original Weight Grams	*Final Weight*	*Loss in Weight*	*Percentage Loss*	*Condition of Surface*
0.5% Sulfuric Acid plus 1.5% Sodium Sulfate **Total immersion—150° F. for two weeks**					
18-8 S	63.445	63.445	.000	.00	Clean
18-8 S Mo	58.503	58.503	.000	.00	Clean
Copper-nickel	70.555	68.908	1.647	2.36	Badly stained
1% Acetic Acid **Total immersion—150° F. for two weeks**					
18-8 S	64.089	64.089	.000	.00	Clean
18-8 S Mo	60.796	60.796	.000	.00	Clean
Copper-nickel	66.885	66.258	.627	0.94	Stained
1% Sodium Hydrosulfite **Total immersion—150° F. for two weeks**					
18-8 S	64.259	64.259	.000	.00	Clean
18-8 S Mo	60.636	60.636	.000	.00	Clean
Copper-nickel	70.196	69.230	.966	1.38	Badly stained and uniformly attacked
1% Formic Acid **Total immersion—150° F. for two weeks**					
18-8 S	64.987	64.987	.000	.00	Stained
18-8 S Mo	62.229	62.229	.000	.00	Clean
Copper-nickel	65.573	64.445	1.128	1.74	Very badly stained uniformly attacked
1% Tannic Acid **Total immersion—150° F. for two weeks**					
18-8 S	63.994	63.994	.000	.00	Stained
18-8 S Mo	59.428	59.429	.000	.00	Stained
Copper-nickel	66.710	66.527	.183	0.27	Pitted
10% Sodium Chloride **Total immersion—150° F. for two weeks**					
18-8 S	65.278	65.235	.043	0.07	Stained
18-8 S Mo	58.225	58.225	.004	0.007	Clean
Copper-nickel	65.907	65.896	.011	0.02	Badly stained
3% Sulfuric Acid Total immersion—70° F. for two weeks					
18-8 S	65.045	65.045	.000	.00	Clean
18-8 S Mo	60.576	60.576	.000	.00	Clean
Copper-nickel	68.179	67.893	.286	0.42	Generally attacked

TABLE II

Dyestuff	*Class*	*Colour Index*	*Acid*	Remarks* *Enduro 18-8-S Mo*	*Copper-Nickel*
Calcocid Violet 4BS Conc.	Acid	53	Acetic	1	11 D
Calcocid Violet 4BX	Acid	695	Sulfuric	1	1
Calcocid Yellow MYXX Conc.	Acid	138	Sulfuric	1	11 G
Calcocid Blue AX	Acid	714	Sulfuric	1	11 D
Calcocid Blue Black EX Conc.	Acid	246	Acetic	1	1
Calcocid Blue SAPX	Acid	1054	Sulfuric	1	11 G
Calcocid Brilliant Scarlet 3RN Conc.	Acid	185	Sulfuric	1	11 D
Calcocid Brown RD	Acid	235	Acetic	1	1
Calcocid Brown Y	Acid	234	Acetic	1	11 D
Calcocid Erythrosine N	Acid	773	Acetic	1	11 Heavier
Calcocid Fast Light Orange 2G	Acid	27	Sulfuric	1	11 DR
Calcocid Fast Red A	Acid	176	Acetic	1	11 D
Calcocid Fast Red BL	Acid	Pr. 62	Sulfuric	1	11 B
Calcocid Fast Yellow 3G Ext.	Acid	636	Acetic	1	11 DR
Calcocid Fuchsine 6B	Acid	57	Sulfuric	1	11 B
Calcocid Green B Conc.	Acid	5	Sulfuric	1	1 V Destroyed
Calcocid Green CG Ext.	Mordant Acid	1078	Acetic	1	1
Calcocid Green G	Acid	666	Sulfuric	1	11 D
Calcocid Green 10G	Acid	Pr. 9	Sulfuric	1	11 D
Calcocid Green SB Extra	Acid	737	Acetic	1	11 Lighter
Calcocid Milling Green 6B	Acid	667	Acetic	1	1
Calcocid Milling Red 3B	Acid	487	Acetic	1	11 D
Calcocid Milling Red G	Acid	443	Acetic	1	11 D
Calcocid Milling Red 3R Conc.	Acid	275	Sulfuric	1	11 B
Calcocid Milling Yellow 3G	Acid	Pr. 102	Acetic	1	111 R
Calcocid Milling Yellow R	Acid	Pr. 114	Acetic	1	11 DR
Calcocid Navy Blue R Conc.	Acid	289	Acetic	1	1
Calcocid Orange Y Ex. Conc.	Acid	151	Sulfuric	1	11 R
Calcocid Phloxine BN	Acid	...	Sulfuric	1	11 B
Calcocid Phloxine 2G	Acid	31	Sulfuric	1	11 B
Calcocid Scarlet Moon	Acid	252	Sulfuric	1	11 B
Calcocid Scarlet 2R	Acid	79	Sulfuric	1	11 B
Calcocid Yellow BN	Acid	146	Acetic	1	1
Calcocid Yellow BT	Acid	138	Sulfuric	1	11 DB
Calcocid Yellow MCG	Acid	640	Sulfuric	1	111 R
Calcocid Yellow R	Acid	138	Acetic	1	11 R
Calcocid Yellow S	Acid	10	Sulfuric	1	11 R
Calco-chrome Blue Black Conc.	Mordant Acid	202	Top Acetic	1	111 R
Calco-chrome Brown B Powder	Mordant Acid	101	Top Acetic	1	111 LR
Calco-chrome Brown EB	Mordant Acid	Pr. 10	Top Acetic	1	11 Lighter
Calco-chrome Brown RA	Mordant Acid	Pr. 3	Top Acetic	1	111 Lighter
Calco-chrome Fast Red ECB	Mordant Acid	652	Bottom Acetic	1	11 DY
Calco-chrome Green SW	Mordant Acid	...	Top Acetic	1	1
Calco-chrome Orange GR	Mordant Acid	274	Top Acetic	1	11 D
Calco-chrome Orange R Ex. Conc.	Mordant Acid	40	Top Acetic	1	1
Calco-chrome Red SR	Mordant Acid	1034	Top Acetic	1	11 B
Calco-chrome Yellow G	Mordant Acid	Pr. 32	Top Sulfuric	1	11 D
Calco-chrome Yellow 2G	Mordant Acid	36	Top Acetic	1	11 B

*In order to interpret the results, the following classification was adopted

1—No color change.

11—Slight change:

D—duller

L—lighter

G—greener

B—bluer

R—redder

Y—yellower

(for example: 11 LB means the sample is lighter and bluer than the original. DR means duller and redder, etc.)

111—Decided change in color, e.g., yellow to orange or blue to R.

1V—Color value destroyed.

The dyeings carried out in porcelain were used as standards for comparison.

TABLE II—Continued

Dyestuff	Class	Colour Index	Acid	Remarks: Enduro 18-8-S Mo	Remarks: Copper-Nickel
Erio Carmine 2B	Mordant Acid	...	Acetic	1	11 R
Erio Chrome Azurol BX	Mordant Acid	720		1	1
Erio Chrome Black A	Mordant Acid	204	Acetic	1	111 R
Erio Chrome Black T	Mordant Acid	203	Acetic	1	111 RB
Erio Chrome Blue Black B	Mordant Acid	201	Acetic	1	111 R
Erio Chrome Brown R	Mordant Acid	...	Acetic	1	111 Y
Erio Chrome Flavine A Conc.	Mordant Acid	219	Acetic	1	1
Erio Chrome Green HK	Mordant Acid	99	Acetic	1	111 B
Erio Chrome Verdon S	Mordant Acid	292	Acetic	1	111 B
Erio Chrome Violet B	Mordant Acid	...	Acetic	1	111 R
Erio Chrome Violet 3B	Mordant Acid	...	Acetic	1	111 R
Erio Chrome Yellow BN	Mordant Acid	...	Acetic	1	1
Erio Chrome Yellow 2G	Mordant Acid	36	Acetic	1	11 D

DIAZOTIZING TEST

Method: 0.3 gm. HCl + 0.15 gms. $NaNO_2$ diluted to 200 c.c., in contact with a metal sleeve in porcelain beaker for a period of two (2) hours, at room temperature (60-70° F.). Rinse with cold water.

Enduro 18-8-*S Mo*

Original Weight	*After 50 Tests*	*Loss in Weight*
123.044 gms.	123.044 gms.	none

Copper-nickel

158.166 gms.	155.12 gms.	3.046 gms.

Remarks: The same with Enduro 18-8S Mo, after the 50th test, was clean with no signs of attack.

The copper-nickel metal was discolored and corroded.

Catalytic action of hydrogen peroxide:

A 1.2 volume hydrogen peroxide bleach bath, alkaline with sodium silicate was prepared. This was then divided into three equal portions. These were allowed to stand for a period of 15 hours.

No. 1 in porcelain

No. 2 in porcelain + 18-8-S Mo

No. 3 in porcelain + copper-nickel alloy.

10 c.c. of each of the solutions were then acidified with sulfuric acid and titrated with permanganate. The following figures represent the average amount of permanganate required:

Porcelain	14
Enduro 18-8-S Mo	13.5
Copper-nickel	11.4

After the fourth test, the metal was examined. In the case of Enduro the surface was clean and when rubbed with a cotton cloth, did not stain the cloth. In the case of copper-nickel, the surface was slightly dulled, and when rubbed with a cloth, a greenish stain was transferred.

CAUSTIC BOIL TEST

Method: The metal sleeve was placed under a reflux condenser and subjected to a six-hour boil in a 4° Tw. caustic solution, containing in addition 10 c.c. H_2O_2 (17 vol.) and 1 c.c. sodium silicate. After the six-hour period the bath was discarded; fresh caustic, peroxide, and silicate were added, and these were boiled again. This was repeated for 10 tests (60 hours).

18-8-S

Original weight 73.976

Final weight ..... 73.976 (No Loss)

(The above test was carried out on stainless steel only.)

CLEANLINESS

In dyeing the various classes of dyes, i.e., direct, sulfur, vat, etc., the following results were noted:

In the case of direct colors there was practically no difference between dyeings in copper-nickel and stainless steel.

In sulfur and vat dyeings the results were similar. It was noted that copper-nickel was stained considerably by the sulfides and sulfites.

The stains in some cases required a chemical treatment to remove them.

The resistance of stainless steel to sulfides was much better, and where stains occurred on this metal in sulfur dyeing, these were due principally to a surface smut of color which was removed by rubbing with cloth and soda-ash.

While stainless steel withstands the action of the hypochlorites of the strength ordinarily used (1-3° Tw.) for the time of bleaching, usually one-half to three-quarter hour, it cannot be used as storage vessels for these solutions.

The advantages that stainless steel offers when compared to the other metals are:—

Greater resistance to chemicals.

Greater strength.

Does not tarnish.

Harder surface.

Does not react with acid or chrome colors.
Easier to clean.

In contacting the industry I have found that the use of "Stainless Steel" is increasing and that it is actually replacing other metals in wool dyeing, in the application of diazo colors, and where high resistance to abrasion is required, for example, in rollers, dye-sticks, drying cans, etc.

While I am exalting the properties of stainless steel, nevertheless I am mindful of the fact that it has its limitations, and should be used with intelligence in order that the best service may be had from it.

In concluding, I wish to thank the Philadelphia Section of the American Association of Textile Chemists and Colorists and also the Republic Steel Corporation, for their cooperation in making this presentation possible.

DISCUSSION OF ALUMINIUM CHLORIDE CARBONIZING

(Continued from page (157) 249)

from 255° to 260° we had the spots. If we carbonized from 260° to 275° we didn't get them any more.

Mr. Ryberg: That is one point I wanted to bring out about raising the temperature. When the temperature is raised, the more complete is the breaking down of the chloride and the better the results in the dye kettle afterward. I haven't run into anything like those so-called spots that you speak of.

Mr. Healy: It is perfectly possible that it was due to undecomposed aluminium chloride because that isn't rinsed out, but if you decompose it thoroughly you can dust it off and it can then be rinsed out with a plain water rinse. I have been to a mill where the temperature of the baker was so low that the decomposition of the aluminium chloride was so small that they had their duster all gummed up simply because the undecomposed aluminium chloride was more or less hygroscopic and became pastey. By increasing the temperature 30° they got away from that.

Mr. Healy: The only case of trouble we have ever had was making streaky dyeings. We finally found out that it was from not running the extractor fast enough. Nothing to do with carbonizing.

Mr. Zillessen: Isn't it true that you can bake at the much higher temperatures with aluminium chloride carbonizing, that the higher heat activates it? I think that is true about the increased heat in carbonizing. One time we found that when carbonizing with aluminium chloride, scouring and then dyeing without neutralizing with a temperature not higher than 250° they were not level. At 270° they were all right.

MEETING, PHILADELPHIA SECTION

A MEETING of the Philadelphia Section was held on Friday, March 8th, at the Broadwood Hotel in Philadelphia.

In addition to the usual routine business, our fellow member, Donald H. Powers of the Rohm & Haas Co., Inc., presented a prepared paper entitled, "Synthetic Resins—Their Application to Textiles."

Dr. Powers described the background, development and future possibilities of these substances in relation to their application to textiles.

Following Dr. Powers, Howard D. Clayton of Cluett, Peabody & Co., Inc., presented a paper on "Sanforizing," accompanied by a motion picture illustrating the process and some appropriate sales methods in relation to the retail sales of materials treated by the process.

Interesting discussions followed both papers.

The Chairman appointed a committee consisting of Harold B. Dohner as Chairman, Albert P. March and Alexander Smith to suggest nominees for the elective officers to serve during the coming year.

The next meeting was announced to be held on Friday, April 26th, at the Broadwood Hotel in Philadelphia.

The attendance was 110.

Respectfully submitted,

R. W. DELANEY,
Assistant Secretary.

Analytical Methods for a Textile Laboratory

The Council of the A.A.T.C.C., believing that Dr. Scott's series of articles entitled "Analytical Methods for a Textile Laboratory" might well be brought together in book form, have proceeded with its publication. Copies may be obtained from the Secretary of the Association, Harold C. Chapin, Lowell Textile Institute, Lowell, Mass., for 75 cents.

STANDARD SILK SAMPLES

There have been prepared, under the direction of the Sub-Committee on Fastness of Dyed Silk, standard dyed silk fabrics to represent four classes of fastness to washing—namely, Class I, Class II, Class III and Class IV. These standards have been carefully dyed with the dyestuffs and according to the dyeing methods recommended in the 1931 Year Book.

The A.A.T.C.C. is prepared to furnish sets of these washing standards for a nominal charge which will cover the cost of preparation. It will be possible to accurately grade the fastness by comparing it with the standards after subjection to the standard washing tests approved by this Association. All inquiries concerning these Silk Washing Standards may be addressed to the Chairman of the Research Committee.

Louis A. Olney,
Lowell Textile Institute,
Lowell, Massachusetts.

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INTERPRETATION OF RESEARCH—I
What Is Interpretation? Who Shall Interpret?

THE interpretation of research has been attracting some attention recently but the title itself seems to be subject to a variety of interpretations. There are so many kinds of research and so many kinds of people who may be interested in some aspect of application of it that our broad title seems not to have any very definite meaning.

We suppose that the most important interpretation, and the most difficult, is to present the research results in terms of dollars and cents because if you cannot evaluate them how can you ask for financial support for research projects? A most natural thought for a mill executive would be something like this, "If he can't get up here and tell me what that research amounts to, how can he expect me to pay for it".

Unless the sponsor of a proposed research has a very definite project, for example a new article of manufacture, or unless he can point to a specific accomplishment in textiles or to something similar in some other line, he has very little as a basis for its presentation aside from generalities which may not be very convincing.

One would expect that an executive who is aware of mechanical and electrical inventions would sense that such things should be possible in his own line and would stake a little on that chance if he could reasonably afford it. There are in the textile industry a good many such broad-minded men who can see the wider, long-time view and who do support some research. With them you do not have to worry so much about interpretation but they should receive tangible evidence now and then of the value of the work.

Here, then, is one kind of interpretation, but there seem to be other types, or needs for them. Pure science does not interest textile men until it has been translated into some possible or completed application. Up to this point the interpretation may not mean a thing except to plant or research chemists, but this interpretation is the source of new scientific advances in the industry and is hardly second in value to any other sort. There is certainly a large amount of it needed in order that we may keep up with physical and colloid chemistry as well as physics, in their possible applications to all sorts of textile problems.

So far our two interpreters are the student of science and the interpreter who is to some extent a promoter, or a reporter of final research results. Between these two extremes are various types of individuals through whom interpretation takes place in steps and more or less indirectly so that it is not a simple clear-cut matter. It is going on all the time somewhat like this: The observations of pure science workers are utilized and perhaps extended by someone who is working more directly on textile research. It may then come to the attention of a laboratory man at the mill. He translates it into a useful test or a process improvement. Thus the foreman gets it and the superintendent. The latter may not know much about it except that he is getting help from the laboratory—but, he has some idea how much it is worth and he has contact with the management. He may not know the detail of the science end of it at all but if he can indicate the result and its value isn't he one of the best interpreters?

There is good reason why the interpretation should be a sort of relay affair. It does not seem necessary that the pure science be presented in any detail to the treasurer. Nor may the technically educated intermediate executives have time to read so-called pure science literature but they know of its existence and will be familiar with some of its interpretations in terms of technical advances in the mills. The live ones will be pushing their chemists and research men (if any) to bring in more and more that may be of use. They should be the best sponsors of research, and its interpreters in terms of business to the head office.

Research, such as working out methods of testing dye fastness and tabulating its results, or studying the working properties of dyes may not be the simplest thing to explain to a head executive. He will probably think (if he does not say) that the chemist is supposed to know all that. But, your intelligent foreman or superintendent can explain that he must have such information; that it saves the firm time and money; and that such research

(Continued on page 263)

In Memoriam

William Ewart Mitchell

Vice President in Charge of Sales
CIBA COMPANY, INC.

It is with the deepest sense of personal bereavement that we record the death, on May 2nd, 1935, of William Ewart Mitchell. His many friends and acquaintances in dyestuff and textile circles will join with us in mourning a loss which will not be soon forgotten.

No contact with Mr. Mitchell's vigorous personality was too slight to leave a lasting impression. Possessed of a keen intellect and boundless energy, he was intolerant of slovenly thinking or doing in others, yet, in his daily contacts, he was a master of diplomacy, inspiring loyalty in his associates and respect among his competitors. He possessed to a marked degree the unusual faculty of being able to maintain vigorously his own opinions without sacrificing the good will of those who might not share his views. He was outspoken, never leaving one in doubt as to his opinion. If he had a grievance, it was discussed at the earliest opportunity, adjusted, and as promptly forgotten.

In addition to his marked executive and technical ability, Mr. Mitchell possessed social charm in no small degree. His popularity was manifest in any gathering, where his dry wit and unfailing good humor caused him to be constantly at the hub of conversation. He was fond of golf and bridge; at the latter he was expert.

Mr. Mitchell was born December 10th, 1891, in Pawtucket, R. I., whence his family removed during his early years to Boston, where he attended grade and high schools. In 1907 he found his first employment in the laboratory of Arthur Merritt a dyestuff distributor of Boston and, while thus occupied, he also took the night course in chemistry at Franklin Union.

In 1909 he went into the Boston laboratory of the Badische Company. Here he remained until 1918, when he came to New York to take charge of the application laboratory of Aniline Dyes & Chemicals, Inc., of which concern Ciba Company is the direct successor.

Mr. Mitchell's native business ability, coupled with his long technical experience, earned him steady increase in responsibility. In 1928 he became Sales Manager of Ciba Company and in 1930 was elected Vice President in Charge of Sales, which position he occupied at the time of his death.

Mr. Mitchell succumbed to a malignant streptococcic infection which developed in January of this year and which failed to respond to treatment. He passed away at the Hotel Suburban, East Orange, N. J., where he had made his home during recent years. Funeral services, widely attended by his many social and business acquaintances, were held on Saturday, May 4th, at Our Lady Help of Christians Church, East Orange, N. J.

Mr. Mitchell was a charter member of the American Association of Textile Chemists and Colorists, in the New York Section of which he had always taken an active part. He was also a member of numerous social and athletic organizations. He is survived by his wife, Jane E. Mitchell, a daughter, Irene, and a son, Arthur.

Stream Pollution and Textile Wastes*

By C. D. BLACKWELDER†

THE problem of stream pollution, due to textile wastes, is of increasing importance to the textile industry. This is evidenced by the fact that almost every State in the Union now has laws prohibiting the discharge of objectionable waste materials from industrial plants into the streams. It is a difficult and complex problem—one which must be studied from every viewpoint before a satisfactory solution can be obtained.

The rapid and increasing growth of our cities and industries has brought in its procession, pollution of streams and problems of sewage and trade waste disposal. Our cities have made great progress in solving the problem of stream pollution caused heretofore by raw sewage being discharged into the streams. In every State, modern sewage disposal plants are being constructed where needed. Great strides have also been made in the past few years by industries in the treatment and disposal of their trade wastes. Some of the industries having waste disposal problems, other than the textile plants, are steel mills, coke plants, oil refineries, canneries, milk product plants, paper and pulp plants, meat packing houses, beet sugar mills, starch factories, dye and chemical manufacturing plants, gas works, tanneries, breweries, and distilleries.

The question arises—What is stream pollution? Water in non-polluted streams carries in solution, along with various other minerals and organic matter, a certain amount of atmospheric oxygen known as dissolved oxygen. If this water is heated, the dissolved oxygen, together with other gases, will be seen to escape in the form of small bubbles, just as the boiling point is reached. If this water is allowed to cool and is exposed to the air, it will reabsorb the atmospheric oxygen up to a certain degree, known as the saturation point. The lower the temperature of the water, the more oxygen the water will absorb. This simple experiment illustrates just what happens in a polluted stream. Discharging into a stream, wastes that are high in oxygen consuming power, causes the stream to give up its dissolved oxygen in order to supply oxygen for the oxidation of the wastes. After the wastes have been oxidized, there may, or may not be any dissolved oxygen left. In any stream the existing condition, as regards dissolved oxygen, is the resultant of the two opposing forces of deaeration, which is due to pollution of the water, and reareation. Shallow, swiftly running streams have a higher rate of reabsorption of oxygen from the atmosphere, while on the other hand, deep, slow moving streams have very little chance of reabsorption of oxygen.

The present statutes concerning the discharge of textile wastes into streams are of importance to organizations seeking locations for new plants, because they concern, not only the disposition of wastes, but in addition a supply of water suitable for textile processing. In nearly every case, the law includes a penalty for violation, however, legal action is taken only when there appears to be no disposition on the part of the manufacturer to effect a remedy. General practice follows a policy of cooperation with the industries, rather than the enforcement of severe requirements.

The degree of treatment required for textile wastes varies greatly with local conditions. Every case of stream pollution has different characteristics and must be studied very carefully from every angle. More purification is required in some instances than in others. The pollution of streams by textile wastes is a complex problem, and one that cannot be solved without expert technology. The treatment of textile wastes, naturally, results in a certain amount of loss to the industry concerned and is an ever present expense. The required treatment of a waste may, in the case of great competition in the manufacturing field, result in converting plant operation from a profit to a loss.

Federal control over discharge of sewage and industrial wastes into streams, lakes and coastal waters, is being sought by legislation to be framed by a committee appointed by Secretary of War Dern. Advocates of Federal control of stream pollution rely on decisions of the United States Supreme Court, that tributaries of navigable streams constitute a part of such waters and are, therefore, subject to the jurisdiction of the Fedreal Government.

The water from many streams is not used for drinking and industrial purposes, and to demand that a manufacturer located on such a stream purify his waste discharge to a crystal clear drinking water standard would be placing an unjustifiable burden upon him. Some States are recognizing this fact, and only require that the wastes be treated to such a degree as not to be objectionable to land owners along the stream, nor to kill fish. Many indus-

*Paper presented before the American Society of Mechanical Engineers, Textile Division Meeting, Greenville, S. C., April 10, 1935.

†Head of Chemical Engineering Department, J. E. Sirrine & Company, Consulting Engineers, Greenville, South Carolina.

trial plants discharge relatively clear wastes, without chemical pollution. The color of a waste may, or may not, be an index of the polluting power of the waste. In many cases, a small amount of dye waste imparts a distinct color to water, yet does not impair the chemical quality of the water. There are other cases where a nearly colorless waste may, because of its high oxygen consuming power, acidity or alkalinity, be very harmful.

Textile industries that are among the main offenders are those that discharge large volumes of liquid wastes containing high percentages of organic solids, highly colored, spent dye and kier liquors, acids, starch wastes, and other chemical compounds. Of all the wastes just mentioned, the kier liquor containing its free caustic, organic matter and high oxygen consuming power, is the most difficult to dispose of properly.

What to do in order to eliminate or reduce stream pollution is a problem requiring intensive study, and it is not within the scope of this paper to undertake to describe the various means of treatment. The solution of textile waste problems involves much more than simple chemistry. It also involves the knowledge of general engineering principles. The problem can best be solved by the chemical engineer, thoroughly familiar with textile bleaching, mercerizing, dyeing, printing, and finishing operations, and the chemicals used in these various processes. He should have well equipped experimental and research laboratories in order to work out the various chemical reactions that are vital in the treatment and disposal of wastes economically.

Treatment of textile wastes is one of the problems that the textile manufacturer usually defers until pressure from an outside source is brought to bear. Many textile plants that are now threatened with law suits from property owners along the streams which are polluted with textile wastes, could put in the necessary plant for treating their wastes for far less than the cost of damage suits, injunctions, and the ill will of the public. These wastes are complex in composition and, therefore, cannot be treated properly without expense.

As waste treatment costs money, it is not economical nor efficient engineering to design a waste disposal plant to turn out a clear neutral effluent, if that degree of purification is not necessary. Various methods of treatment and disposal of textile wastes have been devised. In this short paper, no attempt will be made to describe these various methods, however, one general type of treatment plant, using chemical precipitation, will be mentioned. Local conditions govern largely the selection and degree of treatment.

Some of the wastes discharged from a textile bleaching and finishing plant are acid; some are neutral; and some are alkaline. These conditions may vary from hour to hour, therefore, it is necessary to make a careful study of the natural reactions between these various wastes. Provision should also be made for possible changes in the manufactured product that will of necessity change the chemical processing in the plant, which in turn changes the nature of the waste produced.

In some cases, it is found best to collect all the wastes discharged from a plant into an "averaging" basin or tank before any chemical treatment is applied. In other cases, two or more types of wastes should be collected into a basin, while one or more other kinds of wastes are collected in another basin. After the natural reactions take place between the various wastes in a certain basin, all the wastes are brought together to produce, as near as possible, a standard solution of wastes in a control chamber in which the flow of wastes to be treated is controlled automatically with such accuracy that the application of the chemical treatment will remain correct throughout the day. The wastes should flow into a mixing chamber and the chemicals be applied there, so that the wastes will be thoroughly mixed with the applied chemicals. The length of time the wastes remain in the mixing chamber is dependent on the type of wastes being treated and must be worked out for each individual plant's requirement. After applying the chemical treatment to the wastes, it flows into a flocculation or contact chamber, then into a settling basin. Most textile wastes, when chemically treated, produce a very feathery floc, which is much more delicate than the floc produced in the treatment of water before filtering. This makes it very necessary to avoid any hydraulic disturbances that would cause this floc to break up and redissolve. Large volumes of sludge are produced and means must be provided for removing this sludge at regular intervals or continuously; the latter way is the best, and makes it possible to use smaller settling basins.

Two plants processing exactly the same kind of textiles may have wastes that are very different in character, therefore, the wastes would require entirely different treatments.

It is very necessary to design the settling basins with the required retention period and flowing through velocities in order to allow complete precipitation of the settleable solids. The proper design of the settling basin is a much greater problem than the design of similar basins for water treatment.

In most cases, if the waste problem has been properly solved, the chemical reactions worked out correctly, and the hydraulics of the plant's design are good, no further treatment of the waste will be required. In certain cases, the settled clarified effluent will require filtering or secondary sedimentation, or further chemical treatment, for neutralization or stabilization. In order to handle the drying of the precipitated sludge in the settling basin, sludge drying beds, or lagoons, must be provided. In a great many cases, a portion of the precipitated sludge can be returned continuously by pumping and mixed with the wastes being treated, which reduces the cost of the chemical dosage.

The majority of the manufacturers have a mistaken idea as to the cost of a textile waste disposal plant. When

local conditions are suitable, the "averaging" basin can be constructed of earth, concrete being used only where agitation occurs and for the settling basin. These plants can be designed so they are, practically speaking, automatic in operation, only requiring an attendant for a few minutes each day. Where space is very limited, the disposal plant can be designed on the upward flow principle, the tanks being made of concrete or steel. This type of plant would produce all the functions and reactions that normally take place in a plant laid out for horizontal flow. A plant of this kind finds favor with industries located in municipalities where ordinances have been passed requiring pretreatment of textile wastes before discharging them into the sanitary sewerage system. With this type of plant, the wastes can be treated so they will not cause disintegration of concrete surfaces of manholes, sewer pipe, sewage treatment structures, and the proper operation of sewage disposal plant.

In designing waste disposal plants, a careful study should be made as to the correct chemicals to be used for treatment. Patented compounds should be avoided, due to the usual higher price as compared with simple chemicals that can be obtained almost anywhere on the open market. In some cases, a larger initial investment in the plant is warranted when a reduction in the daily use and cost of chemicals can be made as compared with a less expensive plant requiring a much more expensive chemical dosage.

The cost of textile waste disposal plants and the chemcal cost for operating them varies greatly with the capacity of the plant, the character of the wastes, the dilution factor of the receiving streams, and other local conditions.

The initial cost of the plant varies from $35.00 per 1,000 gallons capacity per 24 hours, to $400.00. The chemical cost for operation varies from one-fourth cent per 1,000 gallons of waste treated up to seventy-five cents.

Manufacturers should keep in mind the possible necessity of having to treat their industrial wastes where danger of law suits or injunctions are eminent. A detailed study of conditions may reveal a waste of chemicals in the processing of the textiles that could be eliminated at quite a saving and at the same time partially eliminate some of the causes of stream pollution.

● NEW DUPONT PRODUCTS

The Dyestuffs Division of E. I. du Pont de Nemours & Company has announced the addition of nine new members to its line of Rotalin colors, and a new waterproofing agent known as Aridex WP.

The new Rotalin Supra colors are composed of Rotalin Yellow G Supra; Rotalin Orange R Supra; Rotalin Chocolate Supra; Rotalin Red S Concentrated Supra; Rotalin Violet Concentrated Supra; Rotalin Blue B Concentrated Supra; Rotalin Brilliant Blue 2B Concentrated Supra; Rotalin Green Y Concentrated Supra; and Rotalin Black RM Supra. "Rotalin" is a registered trademark of the du Pont Company, and patents have been applied for the new members.

It is said that these colors have been added to the division's line of printing ink colors to fill the need for tinctorially strong colors which produce smooth even prints of good fastness to water, rubbing, oils and hot waxing. It is said that the Rotalin Supra colors dissolve readily in methyl and ethyl alcohol and methyl Cellosolve, and will not settle out after solution is complete. Furthermore, when used on a spirit printing machine, it is claimed that these colors have no tendency to fill up around the print, cake or dry on the rolls, or in any way clog the machine. They are expected by the company to find use wherever a quickly drying, bright printing ink color is desired, either alone or in combination to produce an adequate range of shades for all demands.

"Aridex WP," the new waterproofing agent, is intended for producing a water repellent finish on textiles of all kinds as well as on leather and paper. It is recommended by the manufacturers for the spotproofing of rayon and silk crepes, pile fabrics, hosiery, etc., and is said to be excellent for waterproofing umbrella cloth, shower bath curtains, tenting or awning fabrics and heavy materials such as drills and twills for over garments. It is further said to give good results on woolens or worsteds and on mixed cotton and wool materials as well as on bathing suit fabrics. It is claimed that "Aridex WP" possesses excellent laundry fastness and is resistant to dry cleaning solvents, so that it may be used for all materials where permanency of waterproofing is required.

● GENERAL RELEASES

The General Dyestuff Corp. announces release of bulletins on the following products. Copies are available upon request.

Celliton Fast Rubine 3 *B*—a new acetate color said to be of very good fastness to light and to possess good leveling properties. It is stated that inexpensive pink shades may also be produced.

Celliton Fast Scarlet R—a new dyestuff for acetate said to be of very good fastness to light.

Celliton Discharge Brown 5 *R L*—a reddish brown for acetate said to be easily dischargeable with Decroline Soluble Conc. and to be satisfactory for use in application printing.

● SILICATE P'S AND Q'S

The April issue of this publication of the Philadelphia Quartz Co. has now been distributed. Many uses of silicate of soda for the textile industry are discussed. Copies of this bulletin as issued are available upon request.

THE IDENTIFICATION OF DYESTUFFS

(Continued from page 242)

The Chrome Blacks that are usually met with are all azo colors, sensitive to acid, becoming redder, while some of them also give a red with caustic soda, as for example the popular Chrome Blue Blacks B and R. Erio Chrome Black T is not so sensitive to acids as is the A brand. Diamond Black F is but little affected by acids, while with caustic soda it changes from violet solution to a bright blue. Diamond Black PV is red in water solution, changing to violet with acid, but practically unaffected by alkalis. Acid Alizarine Black R becomes orange-red with acid, and with caustic soda gives a dark brown spot with a violet rim. Alizarine Blue Black B is an anthraquinone dye, and is largely used for the dyeing of greys. It is fast to dilute acids and soda ash, but gives a dull green with caustic soda. On reduction with zinc dust and acetic acid a greenish yellow is obtained.

Owing to the restricted range of chrome colors, and the lack of brightness of some of its members, certain acid colors which will withstand the chroming operation are often sold as chrome colors, or admixed with true chrome dyestuffs to brighten the shade. Sulfoncyanine 5R is often sold as a Chrome Navy. Indeed, to get the best results with this color it is wiser to use bichromate in the dyebath, since the dye is very sensitive to reduction, and in the absence of oxidizing agents it sometimes happens that prolonged boiling of the dyebath will turn the color to a flatter shade.

Sulfon Acid Blue R is another dye which is often used as a chrome color, particularly as a base for navies and blacks to dye woolen piece goods and leave silk effect threads white. The Chromotropes and Azo Rubine have already been mentioned. Xylene Light Yellow R, Patent Blue, Acid Green, Acid Violet 4BNS, Erio Violet RL may all be used as shading colors to brighten up the tone of dyeings made with chrome colors. The demand for chrome dyes to dye wool to fast shades and leave silk white has given rise to a number of mixtures. Combinations of Sulfon Acid Blue R, Azo Rubine, Chrome Yellow and Chrome Green are the most popular for this purpose.

SULFUR COLORS

These dyes do not give any definite color reactions with acids and alkalis. When blown out onto the surface of strong sulfuric acid they effervesce with evolution of sulfuretted hydrogen, as already mentioned, but they do not give any distinct coloration. A confirming test for this class of dye is to heat a little of the powder with stannous chloride and hydrochloric acid in a test tube, covering the mouth of the tube with a piece of filter paper which has been spotted with lead acetate solution. Blackening of the paper indicates that the dye is a sulfur color, and is due to the formation of lead sulfide from the lead acetate and the sulfuretted hydrogen evolved. Some of the Sulfur Blues give a yellow or colorless leuco compound on reduction, while those of the Pyrogene Direct Blue RL type remain blue on reduction. Comparison by dyeing trials against a known standard is the only practical method of identifying a sulfur dye.

VAT COLORS

It is well known that the characteristic of any vat dye is the formation of a "vat" with alkaline reducing agents. This "vat" will also give an indication as to which chemical group the dye belongs. The indigoid derivatives all give a yellow or orange vat, while the anthraquinone dyes give dark colored leuco compounds. The powdered dyes, when sprinkled on sulfuric acid, give color reactions, and these colorations, along with the color of the vat, will usually serve to place the individual member. It might be mentioned that some of the thio-indigo dyes give darker vats than the true indigo derivatives. Ciba Scarlet and Ciba Red are cases in point, the former becoming bordeaux and the latter violet on reduction.

INDIGOSOLS

This new group of dyes is not numerous, and little difficulty should be met with in trying to place a sample. The indigosols are soluble in water, giving solutions which are very weak in tinctorial value. They are all precipitated from water solutions by the addition of hydrochloric acid, and an addition of sodium nitrite to the acid suspension causes a development of color value, by oxidizing the ester of the leuco compound to the original vat dye. If an Indigosol is dissolved in strong sulfuric acid weakly colored solution is obtained. The addition of a crystal of sodium nitrite brings about a strong coloration, and the color of the solution so obtained approximates the color which is yielded when the parent vat dye corresponding to the indigosol is dissolved in sulfuric acid.

WASHINGTON NEWS LETTER

(Continued from page 244)

the very existence of which is dependent upon ability to keep in step, colorwise, with the apparel trades. The outstanding example of these infant industries is that devoted to the production of molded plastics. This supply force contacts the textile and apparel industries via such specialties as costume jewelry, buttons, buckles, umbrella handles, handbag fittings, milliners ornaments, etc. Turnover in these lines may well prove to be proportionate to ability to discount the force and direction of the color drift.

To date, few makers of related and unrelated products, who follow in the colortracks of the textile industry, have set up their own agencies for sensing the changing slants to color. But these forces in business are making use, to an ever-increasing extent of the facilities provided by the Textile Color Card Association, the Color Coordination Committee of the Merchandising Division of the National Retail Dry Goods Association, etc. In some instances, accessory manufacturers have made arrangements for independent reports on the Paris openings designed to detail the color trends in the particular classes of goods with which the parties at interest are catering to the American market.

INTERPRETATION OF RESEARCH

(Continued from page 257)

must, naturally, be supported if the results are to be available.

Many mill men know already how scanty is our real knowledge of many of the things that we do every day so successfully. To them it may be easier to present the prospect of learning more about these fundamental and essential things than to attempt to interpret the fragmentary material which may have been accumulated largely by chance and haphazard research.

For successful interpretation where it will do the most good we should, then, have a result and some estimate of its value or, second best, a prospective result with a corresponding estimated value.

Another editorial on this subject will appear in our issue of May 20, 1935.

● AMERICAN ANILINE BOSTON OFFICES

The Boston headquarters of American Aniline Products, Inc. have been removed to 67 Batterymarch Street at the corner of Franklin Street. A much larger laboratory has been installed at the new quarters and larger warehouse facilities are available. The building has been remodeled to include greater office space. It is stated that much larger stocks of colors will be carried to Boston to speed up deliveries and make same day deliveries to New England points.

● COLGATE CHANGES

Following the death of F. C. Ward of the Colgate-Palmolive-Peet Co., A. F. Danz has succeeded to the position of industrial sales manager. Mr. Danz, who was formerly manager of the Pacific Coast division of the company and who has had first hand opportunity to study the needs of the textile field, states that he intends to carry on the expansion and development work which were initiated by Mr. Ward. J. M. Geist, formerly sales manager of the New York division, has been appointed national sales manager for the industrial department. F. C. Boeck, who formerly assisted Mr. Ward, has now been appointed as assistant manager of the industrial department.

● NATIONAL DYES

National Aniline & Chemical Company announces release of circulars on the following products. Copies are available upon request.

National Carbanthrene Black B D Double Paste—a companion product to National Carbanthrene Black B Double Paste but which produces jetter shades than the latter although possessing the same all around fastness. It is recommended by the manufacturers for the production of very fast greys and blacks on cotton, rayon and linen and is especially recommended by them for shirtings, drapery and upholstery materials, sewing threads, knitting and embroidery yarns, trimmings, etc. It is also said to be well suited for the dyeing of effect threads and if these threads are to be used in pieces which are to be subsequently chlorine bleached, aftertreatment of the dyed yarn is unnecessary. It is further stated that this product may also be dyed on silk, producing very fast greys and blacks when aftertreated with nitrous acid (diazotized).

National Erie Brilliant Black S—added to the National line for the specific purpose of providing a superior discharge black for cotton, rayon, pure and tin weighted silk. In this respect it is said to be better than all other National Erie Blacks. It is said to be suitable for discharge styles on a wide range of materials, including unions. It is further stated that its fastness to washing, while fair, is satisfactory for practically all purposes, and may be improved by aftertreatment with formaldehyde.

National Erie Fast Black G—a direct dyeing black for cotton and rayon which is said to possess exceptional fastness to washing when aftertreated with formaldehyde. In this respect it is said to be practically as fast as the Developed Blacks, and has the advantage of easier application. It is stated that this product will discharge to a clear white with hydrosulfite and to possess a further desirable property of leaving acetate unstained. It is recommended by the manufacturers for the dyeing of cotton or rayon-acetate unions, as a ground color for discharge styles and for other purposes requiring superior fastness to washing.

NEW PATENTS

(*Abstracted by S. O. C. M. A.*)

(*Unsymmetrical*) *Indigoid Dyestuff.* (Comprises condensing a 4,7-dialkyl-3-hydroxythionaphthalene with a 3-hydroxythionaphthene treated with a halogenating agent, dyeing various tints of good fastness properties and also convertible into leucoester salts.) Ernst Stoecklin, Binningen, near Basel, Hans Veraguth, Basel, and Fritz Grieshaber, Riehen, near Basel, Switzerland, assignors to Society of Chemical Industry in Basle, Basel, Switzerland, No. 1,990,256, Feb. 5, 1935.

Condensation Product and Process of Making Same. (From "glyoxal-dianthraquinone", dyeing vegetable fiber intense brownish shades of a good fastness; a continuation in part of application Ser. No. 577,157, filed November 24, 1931.) Heinz Scheyer, Frankfort-on-the-Main, Ger., assignor to General Aniline Works, Inc., N. Y., N. Y., No. 1,990,841, Feb. 12, 1935.

Process of Producing Prints or Discharges on Wool and Other Animal Fibers. (By means of a vat dye which comprises adding to the alkaline printing paste an alkali metal salt of amino acetic acid.) Max Zabel, Dessau in Anhalt, Oskar Falek, Wiederitzsch, near Leipzig, and

Hans Seifert, Gut Steinfurth, Post Wolfen, near Bitterfeld, Ger., assignors to General Aniline Works, Inc., N. Y., N. Y., No. 1,990,852, Feb. 12, 1935.

Vat and Sulfur Dyestuff Preparation. (More particularly, comprises printing cotton with a printing color derived from 6.6'-diethoxy-2.2'-bis-thionaphthene indigo, and as a printing assistant a compound of the group consisting of 2-para-toluene-sulfaminoanthraquinone and 2.6-di-para-toluene-sulfaminoanthraquinone.) Hermann Berthold, Leverkusen-I.G. Werk-on-the-Rhine, Ger., assignor to General Aniline Works, Inc., N. Y., N. Y., No. 1,990,854, Feb. 12, 1935.

Process of Preparing Indanthrene Blue. (Or N.N'-dihydro-1.2.1'.2'-anthraquinone-azine by an improved process which consists in adding to fused caustic alkali an aqueous slurry of 2-amino-anthraquinone, having an oxidizing agent selected from the class consisting of alkali metal chlorates and alkali metal nitrates dissolved therein.) Wilfred M. Murch, Midland, Mich., assignor to The Dow Chemical Co., Midland, Mich., No. 1,990,954, Feb. 12, 1935.

Rhodamine Dyes. (Dyeing silks and wool in fast brilliant shades ranging from red to violet; comprises condensing a halogenated aryl-meta-amido-phenol of the benzene series with phthalic anhydride and sulfonating.) Otto Allemann, Wilmington, Del., assignor to E. I. duPont de Nemours & Co., Wilmington, Del., No. 1,991,482, Feb. 19, 1935.

(Green) Disazo Dye and Method for its Preparation. (Dyeing cotton and regenerated cellulose in fast brilliant shades and containing the grouping 1-aryl-azo-2-naphthol-methyl-ether-6-sulfonic acid coupled to an end component which is an amino-benzoyl-1-amino-8-naphthol-4-sulfonic acid.) Henry Jordan, Wilmington, Del., assignor to E. I. duPone de Nemours & Co., Wilmington, Del., No. 1,991,505, Feb 19, 1935.

Pigment and Process of Preparing the Same. (A soft grinding color which comprises introducing a sulfuric acid solution of 1-benzoylamino-4-hydroxy-anthraquinone into an aqueous solution of an alkali-metal carbonate or bicarbonate.) William A. Adamson, So. Milwaukee, Wis., assignor to E. I. duPont de Nemours & Co., Wilmington, Del., No. 1,991,647, Feb. 19, 1935.

Vat Dyestuff and Intermediate of the Pyrene-Quinone and Perylene-Quinone Series. (Derivable by ring closure from a-aroyl-anthracenes.) Ralph N. Lulek and Melvin A. Perkins, Milwaukee, Wis., assignors to E. I. duPont de Nemours & Co., Wilmingtno, Del., No. 1,991,687, Feb. 19, 1935.

Dyestuffs of the Naphthoquinone Series. (Applicable to textile materials generally, for example, to animal fibers, vegetable fibers, or artificial silk or the regenerated cellulose type and obtainable by the action of ammonia on a 5,8-dihydroxy-1.4-naphthoquinone.) George Holland Ellis, Henry Charles Olpin, and Ernest William Kirk, Spondon, near Derby, Eng., assignors to Celanese Corp. of America, No. 1,991,885, Feb. 19, 1935.

● R & H QUARTERLY PRICE LIST

The April price list of the R & H Chemicals Dept. of E. I. duPont de Nemours & Co., Inc., is now available. New listings include a natural refractory, Olivine, which is available in a variety of forms and a reactive chemical, Elemental Potassium. New R & H literature which is now available upon request includes a technical data sheet giving certain physical and chemical properties of the new transparent, thermoplastic hydrocarbon resin, RH-35; an 8 page booklet tabulating business gains of users of Tri-Clene and Artic Service News—a 4 page news bulletin issued periodically to service men and others in the refrigeration industry.

PUBLISHER'S STATEMENT OF CIRCULATION

This is to certify that the average circulation of American Dyestuff Reporter for the six months' period July 1st to and including December 31st, 1934, was as follows:

Copies sold 2117; Copies distributed free 588; Total 2705.

(Signed) A. P. Howes, Publisher.

Submitted to and sworn before me on this 23rd day of April, 1935.

Caroline Essenbreis,
Notary Public.

CLASSIFIED

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

FOR SALE—Large Smith-Drum skein dyeing machine. Suitable for Rayon or Cotton Skein Dyeing, also ribbons and braiding. 100 arms with Monel Metal Tanks, pump and accumulator complete. Will be sold reasonable. Apply—Box No. 856, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

SALESMAN WANTED—Manufacturer of Saponified and Sulfonated Oils, Softeners, Size, Finishing materials and Specialties wants Representatives. Must have experience, personality and following. State territory with which you are acquainted. Salary or commission basis. Give details. Write Box No. 857, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.